RUST GEOTECH INC.

Spectral Gamma-Ray Borehole
Log Data Report

Borehole 51-03-01

Log Event A

Borehole Information

Farm : TX	**Tank :** TX-103	**Site Number :** 299-W15-192
N-Coord : 41,692	**W-Coord :** 73,897	**TOC Elevation :** 670.00
Water Level, ft :	**Date Drilled :** 06/09/1977	

Casing Record

Type : Steel-welded	Thickness : 0.280	ID, in. : 6
Top Depth, ft. : 0	Bottom Depth, ft. : 100	

Borehole Notes:
This borehole was drilled in June 1977. It was started with 18 ft of 8-in. casing and extended to 105 ft with 6-in. casing, which was subsequently withdrawn to 100 ft. The bottom 5 ft of the borehole was filled with concrete. The 8-in. starter casing was removed and the annulus between the borehole wall and the 6-in. casing was filled with grout.

The casing thickness is assumed to be 0.280 in., on the basis of the published thickness of schedule-40 carbon-steel pipe.

The casing collar is about even with the ground surface.

Equipment Information

Logging System : 2	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 10/1995	**Calibration Reference :** GJPO-HAN-3	**Logging Procedure :** P-GJPO-1783

Log Run Information

Log Run Number : 1	**Log Run Date :** 12/28/1995	**Logging Engineer:** Alan Pearson
Start Depth, ft.: 98.0	**Counting Time, sec.:** 100	**L/R :** L **Shield :** N
Finish Depth, ft. : 38.0	**MSA Interval, ft. :** 0.5	**Log Speed, ft/min.:** n/a

Log Run Number : 2	**Log Run Date :** 12/29/1995	**Logging Engineer:** Alan Pearson
Start Depth, ft.: 0.0	**Counting Time, sec.:** 100	**L/R :** L **Shield :** N
Finish Depth, ft. : 39.0	**MSA Interval, ft. :** 0.5	**Log Speed, ft/min.:** n/a

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Analysis Information

Analyst : H.D. Mac Lean

Data Processing Reference : P-GJPO-1787 Analysis Date : 7/31/1996

Analysis Notes :

This borehole was logged by the SGLS in two log runs. The pre- and post-survey field verification spectra met the acceptance criteria established for the peak shape and system efficiency, confirming the SGLS system was operating within specifications. The energy calibration and peak-shape calibration from these verification spectra were used to establish the channel-to-energy parameters used in processing the spectra acquired during the logging operation.

Casing correction factors for a 0.280-in.-thick steel casing were applied during analysis.

A depth overlap, where data were collected by separate logging runs at the same depth, occurred in this borehole between depths of 38 and 39 ft. The calculated concentrations of the natural radionuclides (KUT) using the separate data sets at the overlapping depth points were within the statistical uncertainty of the measurements, indicating very good repeatability of the radionuclide concentration measurements.

The man-made radionuclides Cs-137, Co-60, and Eu-154 were identified in this borehole. The Cs-137 concentrations occur continuously within the upper 16.5 ft of the borehole and intermittently to a depth of 49 ft. The Co-60 and Eu-154 concentrations were encountered below a lithologic contact that occurs at a depth of about 51 ft. The contaminants occur within sandy lithology just below the base of the tank farm excavation. The presence of Cs-137 was noted continuously from the ground surface to a depth of 16.5 ft. Detectable amounts were also noted between depths of 19 and 19.5 ft, between 21 and 22 ft, at 23 ft, between 42 and 43.5 ft, and between depths of 47 and 49 ft. The last two referenced intervals occur just above the contact that overlies the Co-60 and Eu-154 contaminant plume. The maximum Cs-137 concentration in the near-surface continuous zone was about 50 pCi/g. All the radionuclide concentrations between depths of 0 and 18 ft should be considered qualitative, because corrections have not been made for the unknown thickness of grout surrounding this interval of the borehole.

Significant concentrations of Co-60 and Eu-154 were encountered in the depth interval between 51 and 68 ft. The highest measured Co-60 concentration of about 20 pCi/g occurs in the interval between depths of 52 and 54 ft. The maximum measured Eu-154 concentration of about 5 pCi/g occurs in this same interval. A second zone of elevated Co-60 contamination (measured concentrations are in the range of 2 to 4 pCi/g) occurs within the broader contaminated zone between depths of 62 and 66.5 ft. Minor Co-60 concentrations (measured concentrations of less than 1 pCi/g) were encountered intermittently throughout the depth interval between 72 and 74.5 ft. The MDL for this nuclide is about 0.1 pCi/g.

The historical gross gamma-ray count data show a zone of anomalous gamma-ray activity coincident with the Co-60 contamination in the depth interval between approximately 51 and 68 ft. The earliest log in the compilation (August 18, 1982) indicates a zone of anomalous radiometric activity between depths of 50 and 55 ft. The more recent logs show that the intensity of the gamma-ray activity is attenuating roughly in accordance with the activity constants for Co-60 and Eu-154. The anomalous activity at a depth of 64 ft appeared between August 1984 and June 1987; the intensity increased through June 1992 and has been decreasing from that time to the present.

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The presence of Co-60 is indicated by both the 1173- and 1332-keV spectral peaks. The presence of Eu-154 is indicated by the spectral peak at 1274 keV and confirmed by spectral peaks at 1004, 873, and 723 keV.

A distinct increase in the background K-40 concentration, along with a lesser increase in the Th-232 concentration, occurs at a depth of 50 ft, indicating a change in the lithology at this depth. Anomalous lows in th K-40 concentration occur between depths of 6 and 8 ft and between depths of 21 and 23 ft.

The U-238 concentration was not calculated for the spectra acquired between depths of 52 and 58 ft. The processing software was not able to identify the weak 609-keV energy peak on these spectra because the peak was obscured by the elevated Compton continuum from the higher intensity gamma-ray activity associated with the radionuclide contaminants in the depth interval between 51 and 58 ft.

Additional information and interpretations of log data are included in the main body of the TSDR for tank TX-103.

Log Plot Notes:

Separate log plots show the man-made radionuclides (Cs-137, Co-60, and Eu-154) and the naturally occurring radionuclides. The plots of the natural radionuclide concentrations can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations.

A combination plot includes plots of both the man-made and natural radionuclide concentrations, as well a plot of the total gamma activity derived from the spectral data and the Tank Farm gross gamma log prepared from the most recently available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL, which represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A compilation of representative gross gamma-ray logs selected from available historical gamma-ray logs and the SGLS total count-rate log acquired in late 1995 is included. Logs in the compilation were selected at approximately three-year intervals starting from August 1982. The plots show the changes in the gross gamma-ray activity over an approximate 12 year time period.